

**CPC****COOPERATIVE PATENT CLASSIFICATION****B21B**

**ROLLING OF METAL** (auxiliary operations used in connection with metal-working operations covered in [B21](#), see [B21C](#); bending by rolling [B21D](#); manufacture of particular objects, e.g. screws, wheels, rings, barrels, balls, by rolling [B21H](#); pressure welding by means of a rolling mill [B23K 20/04](#))

**NOTE****B21B 1/00**

**Metal-rolling methods or mills for making semi-finished products of solid or profiled cross-section** ([B21B 17/00](#) to [B21B 23/00](#) take precedence; with respect to composition of material to be rolled [B21B 3/00](#); extending closed shapes of metal bands by simultaneous rolling at two or more zones [B21B 5/00](#); metal-rolling stands as units [B21B 13/00](#); continuous casting into moulds having walls formed by moving rolls [B22D 11/06](#)); **Sequence of operations in milling trains; Layout of rolling-mill plant, e.g. grouping of stands; Succession of passes or of sectional pass alternations**

- B21B 1/02 . for rolling heavy work, e.g. ingots, slabs, {blooms} billets, in which the cross-sectional form is unimportant {Rolling combined with forging or pressing}
- B21B 1/024 .. {Forging or pressing (forging or pressing devices as units [B21B 15/0035](#))}
- B21B 1/026 .. {Rolling}
- B21B 1/04 .. in a continuous process
- B21B 1/06 .. in a non-continuous process, {e.g. triplet mill, reversing mill}
- B21B 1/08 . for rolling { structural sections, i.e.} work of special cross-section, e.g. angle steel (rolling metal of indefinite length in repetitive shapes specially designed for the manufacture of particular objects [B21H 8/00](#))
- B21B 1/0805 .. {Flat bars, i.e. having a substantially rectangular cross-section}
- B21B 1/0815 .. {from flat-rolled products, e.g. by longitudinal shearing}
- B21B 1/082 .. Piling sections having lateral edges specially adapted for interlocking with each other in order to build a wall
- B21B 1/085 .. Rail sections
- B21B 1/0855 ... { Rerolling or processing worn or discarded rail sections}
- B21B 1/088 .. H- or I-sections
- B21B 1/0883 ... { using forging or pressing devices}
- B21B 1/0886 ... { using variable-width rolls}
- B21B 1/09 .. L-sections
- B21B 1/092 .. T-sections
- B21B 1/095 .. U-or channel sections
- B21B 1/098 .. Z-sections

**WARNING**

Groups [B21B 1/098](#) is not complete. See also other subgroups of [B21B 1/08](#)

- B21B 1/10 .. in a single two-high or universal rolling mill {stand (**B21B 1/08B to B21B 1/08U take precedence**)}
- B21B 1/12 .. in a continuous process, {i.e. without reversing stands (**B21B 1/08B to B21B 1/08U take precedence**)}
- B21B 1/14 .. in a non-continuous process, {i.e. at least one reversing stand (**B21B 1/08B to B21B 1/08U take precedence**)}
  
- B21B 1/16 . for rolling {wire rods, bars, merchant bars, rounds} wire or material of like small cross-section
- B21B 1/163 .. {Rolling or cold-forming of concrete reinforcement bars or wire (**reinforcement bars per se E04C 5/03**); Rolls therefor}
- B21B 1/166 .. {Rolling wire into sections or flat ribbons}
- B21B 1/18 .. in a continuous process
- B21B 1/20 .. in a non-continuous process, (e.g. skew rolling, i.e. planetary cross rolling)
  
- B21B 1/22 . for rolling {plates, strips,} bands or sheets of indefinite length ([B21B 1/42](#) takes precedence)
- B21B 1/222 .. {in a rolling-drawing process; in a multi-pass mill}
- B21B 1/224 .. {Edge rolling of flat products}
- B21B 1/227 .. {Surface roughening or texturing}
- B21B 1/24 .. in a continuous {or semi-continuous} process {([B21B 1/224](#) takes precedence)}
- B21B 1/26 ... by hot-rolling, {e.g. Steckel hot mill}
- B21B 1/265 .... {and by compressing or pushing the material in rolling direction}
- B21B 1/28 ... by cold-rolling, {e.g. Steckel cold mill}
- B21B 1/30 .. in a non-continuous process {([B21B 1/224](#) takes precedence)}
- B21B 1/32 ... in reversing {single stand} mills, e.g. with intermediate storage reels for accumulating work
- B21B 1/34 .... by hot-rolling
- B21B 1/36 .... by cold-rolling
  
- B21B 1/38 . for rolling sheets of limited length, e.g. folded sheets, superimposed sheets, {pack rolling}([B21B 1/40](#) takes precedence; folding sheets before, or separating layers after, rolling [B21B 47/00](#))
  
- B21B 1/40 . for rolling foils which present special problems, e.g. because of thinness
  
- B21B 1/42 . for step-by-step or planetary rolling (making tubes by pilgrim-step rolling [B21B 21/00](#))
  
- B21B 1/46 . for rolling metal immediately subsequent to continuous casting (metal-rolling stands [B21B 13/22](#); continuous casting [B22D 11/00](#), e.g. into moulds with rolls [B22D 11/06](#))
- B21B 1/463 .. {in a continuous process, i.e. the cast not being cut before rolling}
- B21B 1/466 .. {in a non-continuous process, i.e. the cast being cut before rolling}
  
- B21B 3/00** **Rolling materials of special alloys so far as the composition of the alloy requires or permits special rolling methods or sequences** {Rolling of aluminium, copper, zinc or

other non-ferrous metals}(altering special metallurgical properties of alloys, other than structure consolidation or mechanical properties resulting therefrom [C21D](#), [C22F](#))

- B21B 3/003** . {Rolling non-ferrous metals immediately subsequent to continuous casting, i.e. in-line rolling}
- B21B 3/02** . Rolling special iron alloys, {e.g. stainless steel}
- B21B 5/00** **Extending closed shapes of metal bands by rolling** (manufacture of circular shapes, e.g. wheel rims, [B21H 1/06](#))
- B21B 9/00** **Measures for carrying out rolling operations under special conditions, e.g. in vacuum or inert atmosphere to prevent oxidation of work; Special measures for removing fumes from rolling mills**
- B21B 11/00** **Subsidising the rolling process by subjecting rollers or work to vibrations, {e.g. ultrasonic vibrations}**
- B21B 13/00** **Metal-rolling stands, i.e. an assembly composed of a stand frame, rolls, and accessories**([B21B 17/00](#) to [B21B 23/00](#) take precedence; details, component parts, accessories, auxiliary means, procedures in connection with metal rolling, see the relevant groups)
- B21B 13/001** . { Convertible or tiltable stands, e.g. from duo to universal stands, from horizontal to vertical stands}
- B21B 13/005** . {Cantilevered roll stands}
- B21B 13/008** . {Skew rolling stands, e.g. for rolling rounds}
- B21B 13/02** . with axes of rolls arranged horizontally
- B21B 13/023** .. {the axis of the rolls being other than perpendicular to the direction of movement of the product, e.g. cross-rolling}
- B21B 13/04** .. Three-high arrangement
- B21B 13/06** . with axes of rolls arranged vertically, {e.g. edgers}
- B21B 13/08** . with differently-directed roll axes, e.g. for the so-called "universal" rolling process
- B21B 13/10** .. all axes being arranged in one plane
- B21B 13/103** ... {for rolling bars, rods or wire}
- B21B 13/12** .. axes being arranged in different planes
- B21B 13/14** . having counter-pressure devices acting on rolls to inhibit deflection of same under load; { Back-up rolls}(counter-pressure devices as such [B21B 29/00](#))
- B21B 13/142** .. { by axially shifting the rolls, e.g. rolls with tapered ends or with a curved contour for continuously-variable crown CVC}
- B21B 13/145** .. { Lateral support devices for rolls acting mainly in a direction parallel to the

- movement of the product}
- B21B 13/147 . . {Cluster mills, e.g. Sendzimir mills , Rohn mills, i.e. each work roll being supported by two rolls only arranged symmetrically with respect to the plane passing through the working rolls}
- B21B 13/16 . with alternatively operative rolls, {e.g. revolver stands, turret mills}
- B21B 13/18 . for step-by-step or planetary rolling; {pendulum mills}(methods [B21B 1/42](#); making tubes by pilgrim-step rolling [B21B 21/00](#))
- B21B 13/20 . . for planetary rolling
- B21B 13/22 . for rolling metal immediately subsequent to continuous casting, {i.e. in-line rolling of steel}(methods therefor [B21B 1/46](#); continuous casting [B22D 11/00](#), e.g. into moulds with rolls [B22D 11/06](#))

**B21B 15/00 Arrangements for performing additional metal-working operations specially combined with or arranged in, or specially adapted for use in connection with, metal-rolling mills**

- B21B 15/0007 . {Cutting or shearing the product}
- B21B 15/0035 . {Forging or pressing devices as units}
- B21B 15/0042 . . {Tool changers}
- B21B 15/005 . . {Lubricating, cooling or heating means}
- B21B 15/0085 . {Joining ends of material to continuous strip, bar or sheet}
- B21B 15/02 . in which work is subjected to permanent internal twisting, e.g. for producing reinforcement bars for concrete

**Rolling methods or mills specially designed for making or processing tubes (control of tube rolling [B21B 37/78](#))**

**B21B 17/00 Tube-rolling by rollers of which the axes are arranged essentially perpendicular to the axis of the work, e.g. "axial" tube-rolling**

- B21B 17/02 . with mandrel, {i.e. the mandrel rod contacts the rolled tube over the rod length}(B21B 17/08 takes precedence)
- B21B 17/04 . . in a continuous process
- B21B 17/06 . . in a discontinuous process
- B21B 17/08 . with mandrel having one or more protrusions, {i.e. only the mandrel plugs contact the rolled tube; Press-piercing mills}
- B21B 17/10 . . in a continuous process
- B21B 17/12 . . in a discontinuous process, {e.g. plug-rolling mills}
- B21B 17/14 . without mandrel, {e.g. stretch-reducing mills}

- B21B 19/00**      **Tube-rolling by rollers arranged outside the work and having their axes not perpendicular to the axis of the work (straightening by rollers [B21D](#))**
- [B21B 19/02](#)      . the axes of the rollers being arranged essentially diagonally to the axis of the work, e.g. "cross" tube-rolling {[Diescher mills](#), [Stiefel disc piercers](#), [Stiefel rotary piercers](#)}
- [B21B 19/04](#)      .. Rolling basic material of solid, i.e. non-hollow, structure; Piercing, {e.g. [rotary piercing mills](#)}
- [B21B 19/06](#)      .. Rolling hollow basic material, {e.g. [Assel mills](#)}([B21B 19/04](#) takes precedence; separating work from mandrel [B21C 45/00](#))
- [B21B 19/08](#)      ...      Enlarging tube diameter
- [B21B 19/10](#)      ...      Finishing, e.g. smoothing, sizing, {[reeling](#)}
- [B21B 19/12](#)      . the axes of the rollers being arranged essentially parallel to the axis of the work
- [B21B 19/14](#)      .. Rolling tubes by means of additional rollers arranged inside the tubes
- [B21B 19/16](#)      .. Rolling tubes without additional rollers arranged inside the tubes
- B21B 21/00**      **Pilgrim-step tube-rolling, {i.e. [pilger mills](#)}**
- [B21B 21/005](#)      . {with reciprocating stand, e.g. driving the stand}
- [B21B 21/02](#)      . Rollers therefor
- [B21B 21/04](#)      . Pilgrim-step feeding mechanisms ([B21B 21/06](#) takes precedence)
- [B21B 21/045](#)      ..      {for reciprocating stands}
- [B21B 21/06](#)      . Devices for revolving work between the steps
- [B21B 21/065](#)      ..      {for reciprocating stands}
- B21B 23/00**      **Tube-rolling not restricted to methods provided for in only one of groups [B21B 17/00](#), [B21B 19/00](#), [B21B 21/00](#), e.g. combined processes {[planetary tube rolling](#), auxiliary arrangements, e.g. lubricating, special tube blanks, continuous casting combined with tube rolling}([B21B 25/00](#) takes precedence)**
- B21B 25/00**      **Mandrels for metal tube rolling mills, e.g. mandrels of the types used in the methods covered by group [B21B 17/00](#); Accessories or auxiliary means therefor; {[Construction of, or alloys for, mandrels or plugs](#)}**
- [B21B 25/02](#)      . Guides, supports, or abutments for mandrels, e.g. carriages {or [steadiers](#)}; Adjusting devices for mandrels
- [B21B 25/04](#)      . Cooling or lubricating mandrels during operation
- [B21B 25/06](#)      . Interchanging mandrels, {[fixing plugs on mandrel rods or cooling during interchanging mandrels](#) ([separating tubes from mandrels](#) [B21C 45/00](#))}
- B21B 27/00**      **Rolls, {[roll alloys or roll fabrication](#)}(shape of working surfaces required by special processes [B21B 1/00](#)); **Lubricating, cooling or heating rolls while in use****

- B21B 27/005 . {Rolls with a roughened or textured surface; Methods for making same}
- B21B 27/02 . Shape or construction of rolls (for rolling metal of indefinite length in repetitive shapes specially designed for the manufacture of particular objects [B21H 8/02](#)){([B21B 27/005](#) takes precedence)}
- B21B 27/021 .. {Rolls for sheets or strips}
- B21B 27/024 .. {Rolls for bars, rods, rounds, tubes, wire or the like}
- B21B 27/025 ... {Skew rolls}
- B21B 27/027 .. {Vertical rolls}
- B21B 27/028 .. {Variable-width rolls}
- B21B 27/03 .. Sleeved rolls {([B21B 27/028](#) takes precedence)}
- B21B 27/032 ... {Rolls for sheets or strips}
- B21B 27/035 ... {Rolls for bars, rods, rounds, tubes, wire or the like}
- B21B 27/037 .... {Skew rolls}
- B21B 27/05 ... with deflectable sleeves
- B21B 27/055 .... {with sleeves radially deflectable on a stationary beam by means of hydraulic supports (in general [F16C 13/00](#); for paper-making machines [D21G 1/00](#); regulating devices therefor [B21B 37/36](#))}
- B21B 27/06 . Lubricating, cooling or heating rolls
- B21B 27/08 .. internally
- B21B 27/10 .. externally
- B21B 27/106 ... {Heating the rolls}
- B21B 28/00** **Maintaining rolls or rolling equipment in effective condition (lubricating, cooling or heating rolls while in use [B21B 27/06](#))**
- B21B 28/02 . Maintaining rolls in effective condition, e.g. reconditioning
- B21B 28/04 .. while in use, e.g. polishing {or grinding while the rolls are in their stands}
- B21B 29/00** **Counter-pressure devices acting on rolls to inhibit deflection of same under load, e.g. backing rolls; {Roll bending devices, e.g. hydraulic actuators acting on roll shaft ends (control devices responsive to roll bending [B21B 37/38](#))}**
- B21B 31/00** **Rolling stand structures; Mounting, adjusting, or interchanging rolls, roll mountings, or stand frames**
- B21B 31/02 . Rolling stand frames {or housings}; Roll mountings; {Roll chocks}
- B21B 31/028 .. {Prestressing of rolls or roll mountings in stand frames}
- B21B 31/04 .. with tie rods {in frameless stands}, e.g. prestressed tie rods
- B21B 31/06 .. Fastening stands or frames to foundation, e.g. to the sole plate (in general [F16M](#))
- B21B 31/07 . Adaptation of roll {neck} bearings (bearings in general [F16C](#))
- B21B 31/074 .. {Oil film bearings, e.g. "Morgoil" bearings}
- B21B 31/076 .. {Cooling; Lubricating roller bearings}

- B21B 31/078 .. { Sealing devices (Sealings in general [F16J 15/00](#))}
- B21B 31/08 . Interchanging rolls, roll mountings, or stand frames, {e.g. using C-hooks; Replacing roll chocks on roll shafts}
- B21B 31/10 .. by horizontally displacing, {i.e. horizontal roll changing}
- B21B 31/103 ... {Manipulators or carriages therefor}
- B21B 31/106 ... {Vertical displacement of rolls or roll chocks during horizontal roll changing}
- B21B 31/12 .. by vertically displacing
- B21B 31/14 .. by pivotally displacing
- B21B 31/16 . Adjusting {or positioning} rolls (control devices [B21B 37/00](#))
- B21B 31/18 .. by moving rolls axially
- B21B 31/185 ... {and by crossing rolls}
- B21B 31/20 .. by moving rolls perpendicularly to roll axis
- B21B 31/203 ... {Balancing rolls}
- B21B 31/22 ... mechanically, {e.g. by thrust blocks, inserts for removal}
- B21B 31/24 .... by screws
- B21B 31/26 .... Adjusting eccentrically-mounted roll bearings
- B21B 31/28 .... by toggle-lever mechanisms
- B21B 31/30 .... by wedges or their equivalent
- B21B 31/32 ... by liquid pressure, {e.g. hydromechanical adjusting}
- B21B 33/00** **Safety devices not otherwise provided for** (safety devices in general [F16P](#)); **Breaker blocks; Devices for freeing jammed rolls** {for handling cobbles; Overload safety devices}
- B21B 33/02 . Preventing fracture of rolls
- B21B 35/00** **Drives for metal-rolling mills,** {e.g. hydraulic drives}
- B21B 35/02 . for continuously-operating mills ([B21B 35/10](#), [B21B 35/12](#) take precedence)
- B21B 35/025 .. {for stretch-reducing of tubes}
- B21B 35/04 .. each stand having its own motor or motors
- B21B 35/06 . for non-continuously-operating mills or for single stands ([B21B 35/10](#), [B21B 35/12](#) take precedence)
- B21B 35/08 .. for reversing rolling mills
- B21B 35/10 . Driving arrangements for rolls which have only a low-power drive; Driving arrangements for rolls which receive power from the shaft of another roll
- B21B 35/12 . Toothed-wheel gearings specially adapted for metal-rolling mills; Housings or mountings therefor
- B21B 35/14 . Couplings, driving spindles, or spindle carriers specially adapted for, or specially arranged in, metal-rolling mills (couplings or shafts in general [F16](#))

- B21B 35/141 .. {Rigid spindle couplings, e.g. coupling boxes placed on roll necks (rigid couplings in general [F16D 1/00](#))}
- B21B 35/142 .. {Yielding spindle couplings; Universal joints for spindles (yielding couplings in general [F16D 3/00](#))}
- B21B 35/143 ... {having slidably-interengaging teeth, e.g. gear-type couplings (universal joints with the coupling parts having slidably-interengaging teeth, in general, [F16D 3/18](#))}
- B21B 35/144 .... {Wobbler couplings}
- B21B 35/145 ... {Hooke`s joints or the like with each coupling part pivoted with respect to an intermediate member([Hooke`s joints in general F16D 3/26](#))}
- B21B 35/146 .... {Tongue and slipper joints ([tongue and slipper joints in general F16D 3/265](#))}
- B21B 35/147 .. {Lubrication of spindle couplings}
- B21B 35/148 .. {Spindle carriers or balancers}

**B21B 37/00**      **Control devices or methods specially adapted for metal-rolling mills or the work produced thereby** (methods or devices for measuring specially adapted for metal-rolling mills [B21B 38/00](#))

- B21B 37/005 . {Control of time interval or spacing between workpieces}
- B21B 37/007 . {Control for preventing or reducing vibration, chatter or chatter marks ([B21B 37/66 takes precedence](#))}
- B21B 37/16 . Control of thickness, width, diameter or other transverse dimensions ([B21B 37/58 takes precedence](#))
- B21B 37/165 .. {responsive mainly to the measured thickness of the product}
- B21B 37/18 .. Automatic gauge control
- B21B 37/20 ... in tandem mills
- B21B 37/22 .. Lateral spread control; Width control, e.g. by edge rolling
- B21B 37/24 .. Automatic variation of thickness according to a predetermined programme
- B21B 37/26 ... for obtaining one strip having successive lengths of different constant thickness
- B21B 37/28 . Control of flatness or profile during rolling of strip, sheets or plates
- B21B 37/30 .. using roll camber control
- B21B 37/32 ... by cooling, heating or lubricating the rolls
- B21B 37/34 ... by hydraulic expansion of the rolls
- B21B 37/36 ... by radial displacement of the roll sleeve on a stationary roll beam by means of hydraulic supports
- B21B 37/38 .. using roll bending ([B21B 37/42 takes precedence](#))
- B21B 37/40 .. using axial shifting of the rolls ([B21B 37/42 takes precedence](#))
- B21B 37/42 .. using a combination of roll bending and axial shifting of the rolls
- B21B 37/44 .. using heating, lubricating or water-spray cooling of the product
- B21B 37/46 . Roll speed or drive motor control ([B21B 37/52](#), [B21B 37/60 take precedence](#))
- B21B 37/48 . Tension control; Compression control
- B21B 37/50 .. by looper control

- B21B 37/52 . . . by drive motor control
- B21B 37/54 . . . . including coiler drive control, e.g. reversing mills
- B21B 37/56 . Elongation control
- B21B 37/58 . Roll-force control; Roll-gap control **{(B21B 38/105 takes precedence)}**
- B21B 37/60 . . . by control of a motor which drives an adjusting screw
- B21B 37/62 . . . by control of a hydraulic adjusting device
- B21B 37/64 . . Mill spring or roll spring compensation systems, e.g. control of prestressed mill stands
- B21B 37/66 . . Roll eccentricity compensation systems
- B21B 37/68 . Camber or steering control for strip, sheets or plates, e.g. preventing meandering
- B21B 37/70 . Length control **(B21B 37/56 takes precedence)**
- B21B 37/72 . Rear end control; Front end control
- B21B 37/74 . Temperature control, e.g. by cooling or heating the rolls or the product **(B21B 37/32, B21B 37/44 take precedence)**
- B21B 37/76 . . . Cooling control on the run-out table
- B21B 37/78 . Control of tube rolling
- B21B 38/00** **Methods or devices for measuring, {detecting or monitoring} specially adapted for metal-rolling mills, e.g. position detection, inspection of the product {(Control devices or methods B21B 37/00)}**
- B21B 38/006 . **{for measuring temperature}**
- B21B 38/008 . **{Monitoring or detecting vibration, chatter or chatter marks}**
- B21B 38/02 . for measuring flatness or profile of strips
- B21B 38/04 . for measuring thickness, width, diameter or other transverse dimensions of the product
- B21B 38/06 . for measuring tension or compression
- B21B 38/08 . for measuring roll-force
- B21B 38/10 . for measuring roll-gap, e.g. pass indicators
- B21B 38/105 . . **{Calibrating or presetting roll-gap}**
- B21B 38/12 . for measuring roll camber
- B21B 39/00** **Arrangements for moving, supporting, or positioning work, or controlling its movement, combined with or arranged in, or specially adapted for use in connection with, metal-rolling mills (guiding, conveying, or accumulating easily-flexible**

work in loops or curves [B21B 41/00](#); specially associated with cooling-beds [B21B 43/00](#); conveying or transporting in general [B65G](#))

- B21B 39/002 . {Piling, unpling, unscrambling}
- B21B 39/004 . {Transverse moving}
- B21B 39/006 . { Pinch roll sets}
- B21B 39/008 . {Rollers for roller conveyers (roller-ways in general [B65G 13/00](#), [B21B 39/00](#))}
- B21B 39/02 . Feeding or supporting work; Braking or tensioning arrangements, {e.g. threading arrangements}
- B21B 39/04 . . Lifting or lowering work for conveying purposes, e.g. tilting tables arranged immediately in front of or behind the pass (turn-over or like manipulating means as such [B21B 39/20](#))
- B21B 39/06 . . Pushing or forcing work into pass
- B21B 39/08 . . Braking or tensioning arrangements
- B21B 39/082 . . . { Bridle devices}
- B21B 39/084 . . . { Looper devices}
- B21B 39/086 . . . { Braking devices}
- B21B 39/088 . . . { Bumpers, stopping devices}
- B21B 39/10 . . Arrangement or installation of feeding rollers in rolling stands
- B21B 39/12 . . Arrangement or installation of roller tables in relation to a roll stand
- B21B 39/14 . Guiding, positioning or aligning work ([B21B 43/12](#) takes precedence; guides in which work is subjected to permanent internal twisting [B21B 15/02](#))
- B21B 39/16 . . immediately before entering or after leaving the pass
- B21B 39/165 . . . {Guides or guide rollers for rods, bars, rounds, tubes ([B21B 39/28](#) takes precedence); Aligning guides}
- B21B 39/18 . . Switches for directing work in metal-rolling mills or trains
- B21B 39/20 . Revolving, turning-over, or like manipulation of work, { e.g. revolving in trio stands}(guides in which work is subjected to permanent internal twisting [B21B 15/02](#))
- B21B 39/22 . . by tipping, e.g. by lifting one side by levers or wedges ([B21B 39/26](#), [B21B 39/28](#) take precedence)
- B21B 39/223 . . . {Side-guard manipulators}
- B21B 39/226 . . . {Tiltable ingot chairs}
- B21B 39/24 . . by tongs or grippers
- B21B 39/26 . . by members, e.g. grooved, engaging opposite sides of the work and moved relatively to each other to revolve the work
- B21B 39/28 . . by means of guide members shaped to revolve the work during its passage
- B21B 39/30 . . by lodging it in a rotating ring manipulator or ring segment manipulator
- B21B 39/32 . . Devices specially adapted for turning sheets
- B21B 39/34 . Arrangements or constructional combinations specifically designed to perform functions covered by more than one of groups [B21B 39/02](#), [B21B 39/14](#), [B21B 39/20](#)

- B21B 41/00**                    **Guiding, conveying, or accumulating easily-flexible work, e.g. wire, sheet metal bands, in loops or curves; Loop lifters**
- B21B 41/02                    . Returning work to repeat the pass or passes {within the same stand}
- B21B 41/04                    . .     above or underneath the rolling stand or rolls
- B21B 41/06                    . in which the direction of movement of the work is turned through approximately 180 degrees, {e.g. repeaters, i.e. from one stand to another}
- B21B 41/08                    . without overall change in the general direction of movement of the work
- B21B 41/10                    . .     Loop deflectors {(B21B 39/084 takes precedence)}
- B21B 41/12                    . Arrangements of interest only with respect to provision for indicating or controlling operations
- B21B 43/00**                    **Cooling beds, whether stationary or moving; Means specially associated with cooling beds, e.g. for braking work or for transferring it to or from the bed (conveying means in general B65G)**
- B21B 43/003                    . {Transfer to bed}
- B21B 43/006                    . {Transfer from bed}
- B21B 43/02                    . Cooling beds comprising rakes {racks, walking beams} or bars (B21B 43/10 takes precedence)
- B21B 43/04                    . Cooling beds comprising rolls or worms
- B21B 43/06                    . Cooling beds comprising carriages (B21B 43/08 takes precedence)
- B21B 43/08                    . Cooling beds comprising revolving drums or recycling chains {or discs}
- B21B 43/10                    . Cooling beds with other work-shifting elements projecting through the bed
- B21B 43/12                    . Devices for positioning workpieces "flushed", i.e. with all their axial ends arranged in line on cooling beds or on co-operating conveyers, {e.g. before cutting}
- B21B 45/00**                    **Devices for surface {or other} treatment of work, specially combined with or arranged in, or specially adapted for use in connection with, metal-rolling mills (B21B 15/00, {B21B 1/227 and B21B 27/005} take precedence; technical features of scaling-off devices B21C 43/00)**
- B21B 45/002                    . {Increasing friction between work and working rolls by using friction increasing substance}
- B21B 45/004                    . {Heating the product}
- B21B 45/008                    . {Heat shields}
- B21B 45/02                    . for lubricating, cooling, or cleaning {(in particular in combination with forging or

pressing devices [B21B 15/005](#), control of flatness or profile using lubricating or cooling [B21B 37/44](#)}}

- B21B 45/0203 .. {Cooling}
- B21B 45/0206 ... {Coolants}
- B21B 45/0209 ... {Cooling devices, e.g. using gaseous coolants}
- B21B 45/0215 .... {using liquid coolants, e.g. for sections, for tubes}
- B21B 45/0218 ..... {for strips, sheets, or plates ([B21B 45/023](#), [B21B 45/0233](#) take precedence)}
- B21B 45/0224 ..... {for wire, rods, rounds, bars ([B21B 45/023](#), [B21B 45/0233](#) take precedence)}
- B21B 45/023 ..... {by immersion in a bath}
- B21B 45/0233 ..... {Spray nozzles, Nozzle headers; Spray systems}
- B21B 45/0239 .. {Lubricating}
- B21B 45/0242 ... {Lubricants}
- B21B 45/0245 ... {Lubricating devices}
- B21B 45/0248 .... {using liquid lubricants, e.g. for sections, for tubes}
- B21B 45/0251 ..... {for strips, sheets, or plates}
- B21B 45/0257 ..... {for wire, rods, rounds, bars}
- B21B 45/0263 .... {using solid lubricants}
- B21B 45/0266 .. {Measuring or controlling thickness of liquid films}
- B21B 45/0269 .. {Cleaning}
- B21B 45/0272 ... {Cleaning compositions}
- B21B 45/0275 ... {Cleaning devices}
- B21B 45/0278 .... {removing liquids}
- B21B 45/0281 ..... {removing coolants}
- B21B 45/0284 ..... {removing lubricants}
- B21B 45/0287 .... {removing solid particles, e.g. dust, rust}
- B21B 45/029 ... {Liquid recovering devices}
- B21B 45/0293 .... {Recovering coolants}
- B21B 45/0296 .... {Recovering lubricants}
  
- B21B 45/04 . for de-scaling, {e.g. by brushing (descaling of rod or wire [B21C 43/04](#))}
- B21B 45/06 .. of strip material ([B21B 45/08](#) takes precedence)
- B21B 45/08 .. hydraulically

**B21B 47/00** Auxiliary arrangements, devices or methods in connection with rolling of multi-layer sheets of metal ([soaking pits C21D 9/70](#))

- B21B 47/02 . for folding sheets before rolling
- B21B 47/04 . for separating layers after rolling

**B21B 99/00** Subject matter not provided for in other groups of this subclass

- B21B 2001/00**      **Metal-rolling methods or mills for making semi-finished products of solid or profiled cross-section** ([B21B 17/00](#) to [B21B 23/00](#) take precedence; with respect to composition of material to be rolled [B21B 3/00](#); extending closed shapes of metal bands by simultaneous rolling at two or more zones [B21B 5/00](#); metal-rolling stands as units [B21B 13/00](#); continuous casting into moulds having walls formed by moving rolls [B22D 11/06](#)); **Sequence of operations in milling trains; Layout of rolling-mill plant, e.g. grouping of stands; Succession of passes or of sectional pass alternations**
- B21B 2001/02      . for rolling heavy work, e.g. ingots, slabs, {blooms} billets, in which the cross-sectional form is unimportant {Rolling combined with forging or pressing}
- [B21B 2001/022](#)      .. Blooms or billets
- [B21B 2001/028](#)      .. Slabs
- B21B 2001/08      . for rolling { structural sections, i.e.} work of special cross-section, e.g. angle steel (rolling metal of indefinite length in repetitive shapes specially designed for the manufacture of particular objects [B21H 8/00](#))
- [B21B 2001/081](#)      .. Roughening or texturing surfaces of structural sections, bars, rounds, wire rods
- B21B 2001/22      . for rolling {plates, strips,} bands or sheets of indefinite length ([B21B 1/42](#) takes precedence)
- [B21B 2001/221](#)      .. by cold-rolling
- [B21B 2001/225](#)      .. by hot-rolling
- [B21B 2001/228](#)      .. skin pass rolling or temper rolling
- B21B 2001/38      . for rolling sheets of limited length, e.g. folded sheets, superimposed sheets, {pack rolling}([B21B 1/40](#) takes precedence; folding sheets before, or separating layers after, rolling [B21B 47/00](#))
- [B21B 2001/383](#)      .. Cladded or coated products
- [B21B 2001/386](#)      .. Plates
- B21B 2003/00**      **Rolling materials of special alloys so far as the composition of the alloy requires or permits special rolling methods or sequences** {Rolling of aluminium, copper, zinc or other non-ferrous metals}(altering special metallurgical properties of alloys, other than structure consolidation or mechanical properties resulting therefrom [C21D](#), [C22F](#))
- [B21B 2003/001](#)      . Aluminium or its alloys
- [B21B 2003/005](#)      . Copper or its alloys
- [B21B 2003/006](#)      . Powder metal alloys
- [B21B 2003/008](#)      . Zinc or its alloys
- B21B 2013/00**      **Metal-rolling stands, i.e. an assembly composed of a stand frame, rolls, and accessories**([B21B 17/00](#) to [B21B 23/00](#) take precedence; details, component parts, accessories, auxiliary means, procedures in connection with metal rolling, see the relevant groups)
- [B21B 2013/003](#)      . Inactive rolling stands

- B21B 2013/006 . Multiple strand rolling mills; Mill stands with multiple caliber rolls
- B21B 2013/02 . with axes of rolls arranged horizontally
- B21B 2013/021 .. Twin mills
- B21B 2013/025 .. Quarto, four-high stands
- B21B 2013/026 .. Quinto, five high-stands
- B21B 2013/028 .. Sixto, six-high stands
- B21B 2013/08 . with differently-directed roll axes, e.g. for the so-called "universal" rolling process
- B21B 2013/10 .. all axes being arranged in one plane
- B21B 2013/106 ... for sections, e.g. beams, rails
- B21B 2015/00 Arrangements for performing additional metal-working operations specially combined with or arranged in, or specially adapted for use in connection with, metal-rolling mills**
- B21B 2015/0007 . {Cutting or shearing the product}
- B21B 2015/0014 .. transversely to the rolling direction
- B21B 2015/0021 .. in the rolling direction
- B21B 2015/0028 . Drawing the rolled product
- B21B 2015/0057 . Coiling the rolled product
- B21B 2015/0064 . Uncoiling the rolled product
- B21B 2015/0071 . Levelling the rolled product
- B21B 2015/0078 . Extruding the rolled product
- B21B 2015/0092 . Welding in the rolling direction
- B21B 2023/00 Tube-rolling not restricted to methods provided for in only one of groups [B21B 17/00](#), [B21B 19/00](#), [B21B 21/00](#), e.g. combined processes {planetary tube rolling, auxiliary arrangements, e.g. lubricating, special tube blanks, continuous casting combined with tube rolling}{[B21B 25/00](#) takes precedence}**
- B21B 2023/005 . Roughening or texturing surfaces of tubes
- B21B 2027/00 Rolls, {roll alloys or roll fabrication}{shape of working surfaces required by special processes [B21B 1/00](#)}; Lubricating, cooling or heating rolls while in use**
- B21B 2027/02 . Shape or construction of rolls (for rolling metal of indefinite length in repetitive shapes specially designed for the manufacture of particular objects [B21H 8/02](#)){([B21B 27/005](#) takes precedence)}
- B21B 2027/021 .. {Rolls for sheets or strips}
- B21B 2027/022 ... Rolls having tapered ends

- B21B 2027/06 . Lubricating, cooling or heating rolls
- B21B 2027/08 .. internally
- [B21B 2027/083](#) ... cooling internally
- [B21B 2027/086](#) ... heating internally
- B21B 2027/10 .. externally
- [B21B 2027/103](#) ... cooling externally
  
- B21B 2031/00** **Rolling stand structures; Mounting, adjusting, or interchanging rolls, roll mountings, or stand frames**
  
- B21B 2031/02 . Rolling stand frames {or housings}; Roll mountings; {Roll chocks}
- [B21B 2031/021](#) .. Integral tandem mill housings
- [B21B 2031/023](#) .. Transverse shifting one housing
- [B21B 2031/025](#) .. Shifting the stand in or against the rolling direction
- [B21B 2031/026](#) .. Transverse shifting the stand
  
- B21B 2031/07 . Adaptation of roll {neck} bearings (bearings in general [F16C](#))
- [B21B 2031/072](#) .. Bearing materials
  
- B21B 2031/16 . Adjusting {or positioning} rolls (control devices [B21B 37/00](#))
- B21B 2031/20 .. by moving rolls perpendicularly to roll axis
- [B21B 2031/206](#) ... Horizontal offset of work rolls
  
- B21B 2033/00** **Safety devices not otherwise provided for (safety devices in general [F16P](#)); Breaker blocks; Devices for freeing jammed rolls {for handling cobbles; Overload safety devices}**
  
- [B21B 2033/005](#) . Cobble-freeing
  
- B21B 2035/00** **Drives for metal-rolling mills, {e.g. hydraulic drives}**
  
- [B21B 2035/005](#) . Hydraulic drive motors
  
- B21B 2035/10 . Driving arrangements for rolls which have only a low-power drive; Driving arrangements for rolls which receive power from the shaft of another roll
- [B21B 2035/103](#) .. Fluid-driven rolls or rollers
- [B21B 2035/106](#) .. Non-driven or idler rolls or rollers
  
- B21B 2035/14 . Couplings, driving spindles, or spindle carriers specially adapted for, or specially arranged in, metal-rolling mills (couplings or shafts in general [F16](#))
- [B21B 2035/149](#) .. Measuring devices for spindles or couplings
  
- B21B 2037/00** **Control devices or methods specially adapted for metal-rolling mills or the work produced thereby (methods or devices for measuring specially adapted for metal-rolling mills [B21B 38/00](#))**

- B21B 2037/002 . Mass flow control
  
- B21B 2038/00 **Methods or devices for measuring, {detecting or monitoring} specially adapted for metal-rolling mills, e.g. position detection, inspection of the product {(Control devices or methods [B21B 37/00](#))}**
  
- B21B 2038/002 . Measuring axial forces of rolls
- B21B 2038/004 . Measuring scale thickness
  
- B21B 2045/00 **Devices for surface {or other} treatment of work, specially combined with or arranged in, or specially adapted for use in connection with, metal-rolling mills ([B21B 15/00](#), {[B21B 1/227](#) and [B21B 27/005](#)} take precedence; technical features of scaling-off devices [B21C 43/00](#))**
  
- B21B 2045/004 . {Heating the product}
- B21B 2045/006 .. in vacuum or in inert atmosphere
  
- B21B 2045/02 . for lubricating, cooling, or cleaning {(in particular in combination with forging or pressing devices [B21B 15/005](#), control of flatness or profile using lubricating or cooling [B21B 37/44](#))}
- B21B 2045/0203 .. {Cooling}
- B21B 2045/0209 ... {Cooling devices, e.g. using gaseous coolants}
- B21B 2045/0212 .... using gaseous coolants
- B21B 2045/0215 .... {using liquid coolants, e.g. for sections, for tubes}
- B21B 2045/0221 ..... for structural sections, e.g. H-beams
- B21B 2045/0227 ..... for tubes
- B21B 2045/0236 .. Laying heads for overlapping rings on cooling conveyer
- B21B 2045/0239 .. {Lubricating}
- B21B 2045/0245 ... {Lubricating devices}
- B21B 2045/0248 .... {using liquid lubricants, e.g. for sections, for tubes}
- B21B 2045/0254 ..... for structural sections, e.g. H-beams
- B21B 2045/026 ..... for tubes
  
- B21B 2201/00 Special rolling modes**
  
- B21B 2201/02 . Austenitic rolling
  
- B21B 2201/04 . Ferritic rolling
  
- B21B 2201/06 . Thermomechanical rolling
  
- B21B 2201/08 . Batch rolling

- B21B 2201/10 . Endless rolling
- B21B 2201/12 . Isothermic rolling
- B21B 2201/14 . Soft reduction
- B21B 2201/16 . Two-phase or mixed-phase rolling
- B21B 2201/18 . Vertical rolling pass lines

#### **Equipment codes**

#### **B21B 2203/00 Auxiliary arrangements, devices or methods in combination with rolling mills or rolling methods**

- B21B 2203/02 . Backlash elimination
- B21B 2203/04 . Brakes
- B21B 2203/06 . Cassettes
- B21B 2203/08 . Clutches
- B21B 2203/10 . Counterweights
- B21B 2203/12 . Covers or shieldings
- B21B 2203/14 . Dummy bars or slabs
- B21B 2203/16 . Eccentrics
- B21B 2203/18 . Rolls or rollers
- B21B 2203/182 . . Fluid driven rolls or rollers
- B21B 2203/185 . . Reversible rolls for changing grooves
- B21B 2203/187 . . Tilting rolls
- B21B 2203/20 . Flywheels
- B21B 2203/22 . Hinged chocks
- B21B 2203/24 . Hydrostatic bearings or guides
- B21B 2203/26 . Motors, drives
- B21B 2203/28 . Mounting or dismounting bearing and chock as a unit
- B21B 2203/30 . Quick or bayonet couplings
- B21B 2203/32 . Roll changing stools

B21B 2203/34 . Rotational position or alignment

B21B 2203/36 . Spacers

B21B 2203/38 . Strain gauges

B21B 2203/40 . Torsion bars or shafts

B21B 2203/42 . Turntables

B21B 2203/44 . Vibration dampers

**B21B 2205/00 Particular shaped rolled products**

B21B 2205/02 . Tailored blanks

B21B 2205/04 . Taper- or wedge-shaped profiles

**B21B 2261/00 Product parameters**

B21B 2261/02 . Transverse dimensions

B21B 2261/04 .. Thickness, gauge

B21B 2261/043 ... Blanks with variable thickness in the rolling direction

B21B 2261/046 ... Different thickness in width direction

B21B 2261/05 ... Different constant thicknesses in one rolled product

B21B 2261/06 .. Width

B21B 2261/065 ... Blanks with variable width

B21B 2261/08 .. Diameter

B21B 2261/10 .. Cross-sectional area

B21B 2261/12 . Length

B21B 2261/14 . Roughness

B21B 2261/18 . Weight

B21B 2261/20 . Temperature

B21B 2261/21 .. Temperature profile

B21B 2261/22 . Hardness

**B21B 2263/00 Shape of product**

B21B 2263/02 . Profile, e.g. of plate, hot strip, sections

B21B 2263/04 . Flatness

- B21B 2263/06 .. Edge waves
- B21B 2263/08 .. Centre buckles
- B21B 2263/10 . Lateral spread defects
- B21B 2263/12 .. Dog bone
- B21B 2263/16 . Alligatoring
- B21B 2263/20 . End shape; fish tail; tongue
- B21B 2263/30 . Shape in top view

#### **B21B 2265/00 Forming parameters**

- B21B 2265/02 . Tension
- B21B 2265/04 .. Front or inlet tension
- B21B 2265/06 .. Interstand tension
- B21B 2265/08 .. Back or outlet tension
- B21B 2265/10 . Compression, e.g. longitudinal compression
- B21B 2265/12 . Rolling load or rolling pressure; roll force
- B21B 2265/14 . Reduction rate
- B21B 2265/16 .. Extension
- B21B 2265/18 . Elongation
- B21B 2265/20 . Slip
- B21B 2265/22 . Pass schedule
- B21B 2265/24 . asymmetric rolling

#### **B21B 2267/00 Roll parameters**

- B21B 2267/02 . Roll dimensions
- B21B 2267/06 .. Roll diameter
- B21B 2267/065 ... Top and bottom roll have different diameters; Asymmetrical rolling
- B21B 2267/08 .. Roll eccentricity
- B21B 2267/10 . Roughness of roll surface
- B21B 2267/12 . Roll temperature
- B21B 2267/18 . Roll crown; roll profile
- B21B 2267/19 .. Thermal crown

- B21B 2267/20 . . Ground camber or profile
- B21B 2267/22 . . Hydraulic expansion of rolls
- B21B 2267/24 . Roll wear
- B21B 2267/26 . Hardness of the roll surface
- B21B 2267/28 . Elastic moduli of rolls

**B21B 2269/00 Roll bending or shifting**

- B21B 2269/02 . Roll bending; vertical bending of rolls
- B21B 2269/04 . . Work roll bending
- B21B 2269/06 . . Intermediate roll bending
- B21B 2269/08 . . Back-up roll bending
- B21B 2269/10 . Horizontal bending of rolls
- B21B 2269/12 . Axial shifting the rolls
- B21B 2269/14 . . Work rolls
- B21B 2269/16 . . Intermediate rolls
- B21B 2269/18 . . Back-up rolls

**B21B 2271/00 Mill stand parameters**

- B21B 2271/02 . Roll gap, screw-down position, draft position
- B21B 2271/025 . . Tapered roll gap
- B21B 2271/04 . . Screw-down speed, draft speed
- B21B 2271/06 . Mill spring

**B21B 2273/00 Path parameters**

- B21B 2273/02 . Vertical deviation, e.g. slack, looper height
- B21B 2273/04 . Lateral deviation, meandering, camber of product
- B21B 2273/06 . Threading
- B21B 2273/08 . . Threading-in or before threading-in
- B21B 2273/10 . . Threading-out or after threading-out
- B21B 2273/12 . End of product
- B21B 2273/14 . . Front end or leading end
- B21B 2273/16 . . Tail or rear end
- B21B 2273/18 . Presence of product

- B21B 2273/20 . Track of product
- B21B 2273/22 . Aligning on rolling axis, e.g. of roll calibers
- B21B 2273/24 . Web positioning

**B21B 2275/00 Mill drive parameters**

- B21B 2275/02 . Speed
- B21B 2275/04 .. Roll speed
- B21B 2275/05 ... Speed difference between top and bottom rolls
- B21B 2275/06 .. Product speed
- B21B 2275/08 .. Coiler speed
  
- B21B 2275/10 . Motor power; motor current
- B21B 2275/12 .. Roll torque